

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Application of:

Frankel

Application No.: 10/805,145

Filed: March 19, 2004

For: METHODS FOR FORMING FIBER  
REINFORCED COMPOSITE  
PARTS HAVING ONE OR MORE  
SELECTIVELY POSITIONED  
CORE, STRUCTURAL INSERT, OR  
VENEER PIECES INTEGRALLY  
ASSOCIATED THEREWITH

Group Art Unit: 1732

Confirmation No.: 8651

Examiner: Wollschlager, Jeffrey M.

APPELLANT'S BRIEF (AMENDED)

TO THE COMMISSIONER FOR PATENTS:

This communication is submitted in response to the Final Office Action dated August 20, 2008 ("Office Action") and the Notice of Appeal filed on January 20, 2009. This Brief pertains to the captioned patent application identified above. This Brief is being filed under the provisions of 37 C.F.R. § 41.37.

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## I. REAL PARTY IN INTEREST

The rights of the inventor in this application have been noted assigned to any party; therefore, Kenneth A. Frankel, the sole inventor, is the real party in interest.

## II. RELATED APPEALS AND INTERFERENCES

Appellant and Appellant's legal representative are unaware of any other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the present appeal.

## III. STATUS OF THE CLAIMS

Claims 1-8 and 10-13 are pending and presently stand rejected. Claim 9 has been cancelled. Appellant appeals the rejection of each of Claims 1-8 and 10-13.

## IV. STATUS OF AMENDMENTS

A full set of claims as currently entered is attached in Appendix A. No amendments were filed subsequent to final rejection.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent Claim 1 recites:

A method for forming a hollow composite material part having one or more selectively positioned core, structural insert, or veneer pieces integrally associated therewith, wherein the composite part defines a first shape, and wherein the method comprises at least the following steps:

providing a dissolvable solid mandrel having an exterior surface and a second shape that is substantially the same as but sized smaller than the first shape of the composite material part, wherein the mandrel has one or more selectively positioned recesses that are complementary to the one or more core, structural insert, or veneer pieces;

forming an elastic layer about the mandrel to define an elastic bladder;

applying a vacuum in between the bladder and the mandrel to thereby force and conform the bladder against the exterior surface of the mandrel;

applying a resin and a fiber material about and immediately adjacent to the bladder, and positioning at least one of the one or more core, structural insert, or veneer pieces adjacent and proximate to one of the one or more selectively positioned recesses to define an uncured part;

placing the uncured part into a split mold, wherein the split mold has an interior surface and a third shape that is substantially the same as the first shape of the composite material part;

applying a fluid or gas pressure in between the mandrel and the uncured part to thereby force and conform the uncured part against the interior surface of the split mold;

heating the split mold to a temperature and for a period of time sufficient to cure the resin to thereby define the composite material part;

liquefying and removing the mandrel from within the composite material part; and

optionally removing the bladder from within the composite material part.

Claims 1 finds general support in the Figures and at Para. [009], which paragraph identically discloses all of the above-recited limitations except those that have been underlined. Support for the limitations that relate to a “dissolvable solid” mandrel may be found at Para. [0020] (which paragraph recites that “the mandrel 10 is made of a material that is readily meltable, dissolvable, or otherwise disintegratable such as, for example, a wax or a foamed material”). Support for the limitations that relate to “and immediately adjacent” to the bladder may be found in Figure 3 and at Para. [0022] (which paragraph recites that “a resin pre-impregnated fiber glass cloth material 29 may be uniformly wrapped about the mandrel 10 and bladder 24”). Support for the limitations that a “split” mold may be found in Figure 5 and at Para. [0020] (which paragraph recites that “[t]he mandrel 10 is generally formed from a split mold 16”). Finally, support for the limitations that relate to “liquefying and” removing the mandrel may be found at Para. [0023] (which paragraph recites that “the mandrel 10 may then be removed from within the cavity of the hollow composite material part 32 by heating to liquefy”).

Thus, pending Claim 1 recites a method for forming a hollow composite material part in a unique manner that is not taught or suggested by the prior art of record. Put simply, Claim 1 recites a method that includes provisions for forming an “elastic bladder” about a mandrel, and applying a resin and a fiber material about and immediately adjacent to the elastic bladder (which method is contrary to the prior art of record method that teaches applying a resin and a fiber material about and immediately adjacent to a “hard surface”).

## VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

The issues in this appeal are as follows:

1. Whether Claims 1, 3, 5-8 and 10-13 are obvious under 35 U.S.C. § 103(a) in view of U.S. Patent No 5,137,071 to Ashton et al. in combination with U.S. Patent No. 6,458,306 to Nelson et al., and as evidenced by either U.S. Patent No. 7,007,755 to Reddy et al. or U.S. Patent No. 6,110,406 to Ishibashi et al., wherein neither *Ashton* nor *Nelson* teaches or suggests, alone or in combination, forming an “elastic bladder” and “applying a resin and a fiber material about and immediately adjacent to the elastic bladder” as claimed in independent Claim 1, and wherein *Ashton* expressly teaches applying a resin and a fiber material about and immediately adjacent to a “hard surface.”
2. Whether one of ordinary skill in the art would recognize that the hard ABS polymer layer taught by *Ashton* is not elastic, especially in view of (1) the Examiner’s admission that ABS is not generally considered to be an elastomer/elastomeric material, and (2) a Rule 1.132 Declaration by a professor of polymer science and chemistry that attest that the ABS polymer layer taught by *Ashton* is not elastic.

## VII. ARGUMENT

**Issue 1: Claims 1, 3, 5-8 and 10-13 are not obvious in view of *Ashton* in combination with *Nelson* because *Ashton* teaches applying a resin and fiber material about an inflatable bladder having a hard surface**

Claims 1, 3, 5-8 and 10-13 stand rejected under 35 U.S.C. § 103(a) as being obvious in view of U.S. Patent No. 5,137,071 to Ashton et al. in combination with U.S. Patent No. 6,458,306 to Nelson et al., and as evidenced by either U.S. Patent No. 7,007,755 to Reddy et al. or U.S. Patent No. 6,110,406 to Ishibashi et al. Appellant respectfully submits that the Examiner’s obviousness rejections are clearly erroneous errors.

At base, the Examiner erred by taking and maintaining the position that the ABS material taught by U.S. Patent No. 5,137,071 to Ashton et al. is an “elastic” material (and, therefore, the claimed invention is obvious – meaning that the Examiner equates the “elastic bladder” recited in the presently claimed invention to be the same as the combined ABS layer/silicone rubber layer taught by Ashton et al.). In this regard, the Examiner does not dispute the fact that the ABS layer

taught by Ashton et al. may be considered “hard”<sup>1</sup>; however, the Examiner notes “that whether ABS is considered ‘hard’ does not refute the fact that ABS is elastic.” (Office Action dated 02/04/2008 at page 6, first full paragraph). Appellant respectfully disagrees with the Examiner’s conclusion. Contrary to the Examiner’s position, the fact that the ABS layer taught by Ashton et al. is considered “hard” conclusively demonstrates that it may not also be considered “elastic.” In other words, the ABS layer taught by Ashton et al. may be either a hard plastic or an elastomeric plastic, but not both.

In considering Appellant’s arguments regarding patentability, the Examiner does, however, correctly point out the butadiene component of Acrylonitrile-Butadiene-Styrene (ABS) imparts elasticity to the ABS polymer chain. The Examiner’s further syllogism regarding car dashboards made of ABS (and their ability to be compressed without cracking and subsequently returned to their original shape) is largely misplaced, however, because this analogy fails to consider the mechanical effects imparted by the “closed cells” that make up “foamed” ABS dashboard. Moreover, and contrary to the views of those having knowledge of polymer chemistry, the Examiner in support of his erroneous position points to two supporting references, Reddy et al. and Ishibashi et al., for purposes of demonstrating “the fact that ABS is an elastic material” (Office Action dated 02/04/2008 at page 6, second paragraph). A careful review of each of these additional references, however, demonstrates that neither fully supports the Examiner’s position.

Indeed, U.S. Patent No. 7,007,755 to Reddy et al. (which is not a proper prior art reference under 35 U.S.C. §102/103) is directed to elastomeric admixtures that comprise a cementitious material, an ABS polymer, and water; and with respect to the ABS polymer component this reference clearly teaches:

ABS used with the present embodiments is often produced as a composite material. In the production of such a composite material, a preformed elastomer such as polybutadiene or styrene butadiene rubber is used as a substrate, and styrene and acrylonitrile monomers are grafted onto the substrate by polymerization. In addition, styrene and acrylonitrile that fail to graft to the substrate copolymerize to form a matrix, with the grafted substrate dispersed in the matrix. Higher levels of butadiene in the final product increases the

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<sup>1</sup> Indeed, the central idea behind the Ashton et al. reference is to provide a hard, but heat-softenable, mandrel (referred to as the ABS layer) upon which various composite materials and resins can be initially assembled; thereafter, an inflatable “elastic” layer of silicone rubber (referred to as the envelope bag) is pressurized so as to push against the rigid ABS layer and compact the “laid-up” composite materials and resins against a hard outer mold surface.

elastomeric properties of the composite material. In contrast, higher levels of styrene and acrylonitrile in the final product decrease the elastomeric properties of the composite material. As can be appreciated, the character of the ABS varies by the composition of the composite material, and thus affects the mechanical properties of the cementing composition.

Specification at col. 2, lines 27-44 (*emphasis added*).

As best as Appellant can tell, this reference merely supports the well established principal that more butadiene increases elastomeric properties, whereas less butadiene decreases elastomeric properties. This reference nowhere teaches or suggests that ABS polymer is considered to be an elastomeric material or that it otherwise possesses elastic properties. U.S. Patent No. 6,110,406 to Ishibashi et al., on the other hand, merely suggests that specialty core/shell graft ABS polymers exists and that these types of specialty polymers may be considered elastomeric.

For purposes of clarity and enhanced understanding of the fundamental issues and teachings of the prior art, Appellant believes that a short overview of ABS polymer chemistry is in order. To this end, Appellant respectfully submits that ABS is a terpolymer whose sales have grown over the years (first introduced commercially in the 1940s) to become the largest engineering thermoplastic in the world. The versatility of ABS is derived from its three monomeric building blocks - acrylonitrile, butadiene, and styrene. Each component imparts a different set of useful properties to the final polymer. Acrylonitrile primarily offers chemical resistance and heat stability; butadiene delivers toughness and impact strength; and the styrene component provides ABS with rigidity and processability. ABS materials are normally prepared with 50% or more styrene monomer in one of three manufacturing processes – emulsion, continuous mass (bulk), or suspension. Often, more than one of these processes is combined, optimizing the final polymer. ABS resin is a two-phase system having a styrene-acrylonitrile copolymer (SAN) as a continuous phase with a dispersed elastomeric phase of butadiene-derived rubber. In actuality, small amounts of styrene and acrylonitrile are copolymerized (grafted) onto the butadiene rubber component to compatibilize the otherwise rigid SAN and rubber phases. Thus, ABS has been viewed as one of the first commercially successful polymer alloys.

By varying the ratio of the three A-B-S monomers, the molecular weight of the overall polymer, and morphology of the rubber phase provides an unlimited number of product options within the ABS family. For example, the particle size of the rubber phase may be varied from less than 0.1 micron to several microns. Moreover, the average particle size and the particle size distribution within this rubber phase have dramatic effects on the overall balance of properties including strength, toughness, and rigidity/elasticity. Finally, and although ABS may be



manufactured to be elastomeric in certain instances, the overwhelming majority of ABS sold in commerce is considered to be rigid. For example, Wikipedia describes ABS in the following way:

**Acrylonitrile butadiene styrene**, or **ABS**, (chemical formula  $(C_8H_8 \cdot C_4H_6 \cdot C_3H_3N)_n$ ) is a common thermoplastic used to make light, **rigid**, molded products such as piping, musical instruments (most notably recorders and plastic clarinets), golf club heads (used for its good shock absorbance), automotive body parts, wheel covers, enclosures, protective head gear, vballs [reusable paintballs], and toys including LEGO bricks. In plumbing, ABS pipes are the black pipes (PVC pipes are white) and also in Plastic Pressure Pipe Systems. ABS plastic ground down to an average diameter of less than 1 micrometer is used as the colorant in some tattoo inks.

...

It is a copolymer made by polymerizing styrene and acrylonitrile in the presence of polybutadiene. The proportions can vary from 15 to 35% acrylonitrile, 5 to 30% butadiene and 40 to 60% styrene. The result is a long chain of polybutadiene criss-crossed with shorter chains of poly(styrene-co-acrylonitrile). The nitrile groups from neighboring chains, being polar, attract each other and bind the chains together, making ABS stronger than pure polystyrene. The styrene gives the plastic a shiny, impervious surface. The butadiene, a rubbery substance, provides resilience even at low temperatures. ABS can be used between  $-25$  and  $60^\circ\text{C}$ . The properties are created by rubber toughening, where fine particles of elastomer are distributed throughout the rigid matrix.

...

ABS is derived from acrylonitrile, butadiene, and styrene. Acrylonitrile is a synthetic monomer produced from propylene and ammonia; butadiene is a petroleum hydrocarbon obtained from butane; and styrene monomers, derived from coal, are commercially obtained from benzene and ethylene from coal. The advantage of ABS is that this material combines the strength and rigidity of the acrylonitrile and styrene polymers with the toughness of the polybutadiene rubber. The most important mechanical properties of ABS are resistance and toughness. A variety of modifications can be made to improve impact resistance, toughness, and heat resistance. The impact resistance can be amplified by increasing the proportions of polybutadiene in relation to styrene and acrylonitrile although this causes changes in other properties. Impact resistance does not fall off rapidly at lower temperatures. Stability under load is excellent with limited loads.

[http://en.wikipedia.org/wiki/Acrylonitrile\\_butadiene\\_styrene](http://en.wikipedia.org/wiki/Acrylonitrile_butadiene_styrene)

In view of this background (especially with respect to the unlimited number of product options within the ABS family) and express teachings of Ashton et al.<sup>2</sup>, Appellant fails to understand how the Examiner can rationally take the position that the admittedly hard ABS layer (in combination with a silicone rubber elastic layer/envelope bag) of Ashton et al. defines an elastic bladder as recited in the presently claimed invention. As is appreciated by those skilled in the art, ABS polymer is generally considered to be a hard, rigid plastic, and not an elastomeric plastic.

**Issue 2: The hard ABS polymer layer taught by *Ashton* is not elastic**

The Examiner also erred in determining that one of ordinary skill in the art would recognize that the hard ABS polymer layer taught by *Ashton* is not elastic. Confusingly, the Examiner readily admits that ABS is not generally considered to be an elastomer/elastomeric material. In addition, the Examiner readily agrees that the Rule 1.132 Declaration submitted by Professor Graham Allan provides evidence in favor of Appellant's position that ABS is not elastic. Nonetheless, the Examiner erroneously concludes:

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<sup>2</sup> In this regard, Ashton et al. states the following:

It can therefore be seen that it is desired to have the foundation of a hard surface upon which to build a composite structure. The interior surface of the uncured portions of a composite structure needs to be placed against a hard structure, so as to eliminate distortion or sagging in the structure, prior to the curing process.

Ashton et al. at col. 2, lines 9-14 (*emphasis added*).

The uncured portions of the composite structure, such as the inserts and/or filament windings requires to form the structure, are therefore initially assembled on the hard surface of the ABS layer. Prior to the start of the cure of the composite structure pressure is applied to the back surface of the layer and heat is applied to the ABS layer to soften the layer, the pressure is applied to the back surface of the layer and heat is applied to the ABS layer to soften the layer, the pressure forcing the heat-softened layer and the assembled uncured portions of the composite structure outwardly into contact with the exterior mold surface.

Shrinkage of the composite structure due to the de-bulking process during the cure cycles is therefore entirely compensated for by the softening of the ABS layer and its outward movement towards the exterior mold surface.

The ABS layer therefore provides a hard surface when needed during the assembly of the uncured portions of the composite structure, so as to allow the portions of the structure to be precisely positioned prior to the cure.

Ashton et al. at col. 3, lines 9-29 (*emphasis added*).

Additionally, Appellant argues and the declaration states that the ABS layer of Ashton et al. is not elastic. This argument is not persuasive. While the examiner agrees that the submission by Mr. [Dr.] Allan provides a piece of evidence in favor of Appellant's position that ABS is not elastic, the examiner points to other evidence on the record which appears to contradict this assertion. For example, the Reddy et al. reference, forms "elastomeric" concrete mixtures (Title) that have "greater elasticity" (col. 1, line 65) as a result of the "elastomeric" properties of ABS (col. 2, lines 1-44). Indeed Appellant's June 4, 2008 response agrees that "the butadiene component of Acrylonitrile-Butadiene-Styrene (ABS) imparts elasticity to the ABS polymer chain." (page 5, third full paragraph). Since ABS, by definition, contains butadiene, the examiner submits the ABS is reasonably interpreted to be elastic. The examiner further submits his assertion regarding ABS being "elastic" would be further supported by a basic stress-strain curve for ABS. Such a curve would show an "elastic region" in the ABS material prior to yield (e.g. Young's Modulus, Yield Strength, and Modulus of Elasticity). As such, the examiner submits that in one reasonable interpretation, the ABS layer is reasonably understood to form an elastic bladder.

Office Action dated 08/20/2008 at pages 6-7, spanning paragraph)).

Appellant agrees that certain non-commercially relevant varieties of ABS have elastomeric qualities; Appellant, however, respectfully disagrees that this means that "ABS is reasonably interpreted to be elastic." Appellant further respectfully disagrees with the Examiner's assertion regarding what "a basic stress-strain curve for ABS" would tend to show as no such curve has been made of record (meaning that Appellant has nothing to refute). Nonetheless, Appellant recognizes that virtually all materials (such as, for example, a hard metal like steel or a hard plastic like ABS) could be subjected to a stress-strain analysis and that such analyses generally tend to show regions under the curve in which the underlying material exhibits elastic regions. This does not mean, however, that the underlying material would necessarily be considered to be elastic. Indeed, steel is a good example of a material that when subjected to a stress-strain analysis tends to show an "elastic region," but common sense dictates that steel is not generally considered to be an elastic material. Similarly, ABS when subjected to a stress-strain analysis may tend to show an "elastic region," but ABS is not generally considered to be an elastic material.

### VIII. SUMMARY

In view of the foregoing, Appellants respectfully request reconsideration and withdrawal of the obviousness rejections of Claims 1, 3, 5-8 and 10-13. In sum, Appellant submits that Claims 1, 3, 5-8 and 10-13 are not obvious in view of *Ashton* in combination with *Nelson* because *Ashton* teaches applying a resin and fiber material about an inflatable bladder having a hard surface. Appellant further submits that one of ordinary skill in the art would recognize that the hard ABS polymer layer taught by *Ashton* is not elastic, especially in view of (1) the Examiner's admission that ABS is not generally considered to be an elastomer/elastomeric material, and (2) a Rule 1.132 Declaration by a professor of polymer science and chemistry that attest that the ABS polymer layer taught by *Ashton* is not elastic.

Appellants therefore submit that all pending claims are in condition for allowance. Accordingly, early and favorable action allowing all of the pending claims and passing this application to issue is respectfully requested. The Board is invited to contact the undersigned attorney at the telephone number below if there are any remaining questions regarding this application.

We believe the appropriate fees accompany this transmission. If, however, insufficient fee payment or fee overpayment occurs, the amount may be withdrawn or deposited from/to Axios Law Group's deposit account. The deposit account number is 50-4051.

Respectfully submitted,

Date: April 22, 2009  
~~March 20, 2009~~

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## IX. CLAIMS APPENDIX A

1. (previously presented): A method for forming a hollow composite material part having one or more selectively positioned core, structural insert, or veneer pieces integrally associated therewith, wherein the composite part defines a first shape, and wherein the method comprises at least the following steps:

providing a dissolvable solid mandrel having an exterior surface and a second shape that is substantially the same as but sized smaller than the first shape of the composite material part, wherein the mandrel has one or more selectively positioned recesses that are complementary to the one or more core, structural insert, or veneer pieces;

forming an elastic layer about the mandrel to define an elastic bladder;

applying a vacuum in between the bladder and the mandrel to thereby force and conform the bladder against the exterior surface of the mandrel;

applying a resin and a fiber material about and immediately adjacent to the bladder, and positioning at least one of the one or more core, structural insert, or veneer pieces adjacent and proximate to one of the one or more selectively positioned recesses to define an uncured part;

placing the uncured part into a split mold, wherein the split mold has an interior surface and a third shape that is substantially the same as the first shape of the composite material part;

applying a fluid or gas pressure in between the mandrel and the uncured part to thereby force and conform the uncured part against the interior surface of the split mold;

heating the split mold to a temperature and for a period of time sufficient to cure the resin to thereby define the composite material part;

liquefying and removing the mandrel from within the composite material part;

and

optionally removing the bladder from within the composite material part

2. (previously presented): The method of claim 1 wherein the one or more core pieces is made from a honeycomb material.

3. (previously presented): The method of claim 1 wherein the one or more structural insert pieces is made from a metal or a plastic.

4. (previously presented): The method of claim 1 wherein the one or more veneer pieces is made from a wood.

5. (previously presented): The method of claim 1 wherein the dissolvable mandrel is made of a wax or a foamed material.

6. (previously presented): The method of claim 1 wherein the bladder is made from a silicone rubber material.

7. (previously presented): The method of claim 1 wherein the resin is selected from one or more of a polyester resin, a vinyl ester resin, an epoxy resin, and a phenolic resin.

8. (previously presented): The method of claim 1 wherein the fiber material is selected from one or more of a glass fiber material and a carbon fiber material.

9. (cancelled).

10. (previously presented): The method of claim 1 wherein the applied fluid or gas pressure ranges from about 50 psi to about 150 psi.

11. (previously presented): The method of claim 1 wherein the temperature of the heated split mold ranges from about room temperature to about 400°F

12. (previously presented): The method of claim 1 wherein the period of time sufficient to cure the resin ranges from about 30 minutes to about 4 hours.

13. (previously presented): The method of claim 1, further comprising the step of applying a second vacuum in between the uncured part and the interior surface of the mold.

X. EVIDENCE APPENDIX

A copy of the Declaration of Professor Graham Allan submitted on June 26, 2008 (which evidence was acknowledged by the Examiner in his final rejection dated August 20, 2008) follows this page.



XI. RELATED PROCEEDINGS APPENDIX

NONE.